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Development of Sizing-free Multi-Functional Carbon Fibre Nanocomposites

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Table S1 Typical fibre properties obtained from the manufacturer, Mitsubishi Rayon Co. Ltd.

Property	***Value***
Fibre diameter	7 µm
Number of filaments	3000
Tow tensile strength	4410 MPa
Tow tensile modulus	235 GPa
Typical density	1.79 g/cm^3

Table S2 Properties of the low viscosity epoxy resin.

Property	***Value***
Pot life at 25 ^{o}C	80 - 100 mins
Gelation time at 25 ^{o}C	8 - 11 hrs
Demould time at 25 ^{o}C	18 - 24 hrs
Density at 25 ^{o}C	1.08 - 1.12 g/ml
Maximum T_g	92 – 98 ^{o}C
Elongation at break	6 - 8 %
Tensile strength	65.5 - 73.5 MPa

Table S3 Polishing process for cross-sectional analysis.

Polishing Stage	Consumable	Lubricants (Flow Rate, ml/s)	Polishing Speed (rpm)	Polishing Time (min)
1	Struers A/S, SiC, 200 mm, 500 Grit	Water (13)	50	3
2	Struers A/S, SiC, 200 mm, 1200 Grit	Water (13)	50	3
3	Struers A/S, SiC, 200 mm, 2400 Grit	Water (13)	50	3
4	Buehler FiberMett, 200 mm, 3 µm	Water (1)	50	5
5	Buehler, 200 mm, 1 µm,	Water (1)	50	5
6	Buehler Ultra-Prep, 200 mm, 0.5 µm	Water (1)	50	5
7	Buehler, 200 mm, 0.3 µm	Water (1)	50	5
8	Buehler FiberMet, 200 mm 0.05 µm,	Water (1)	50	5

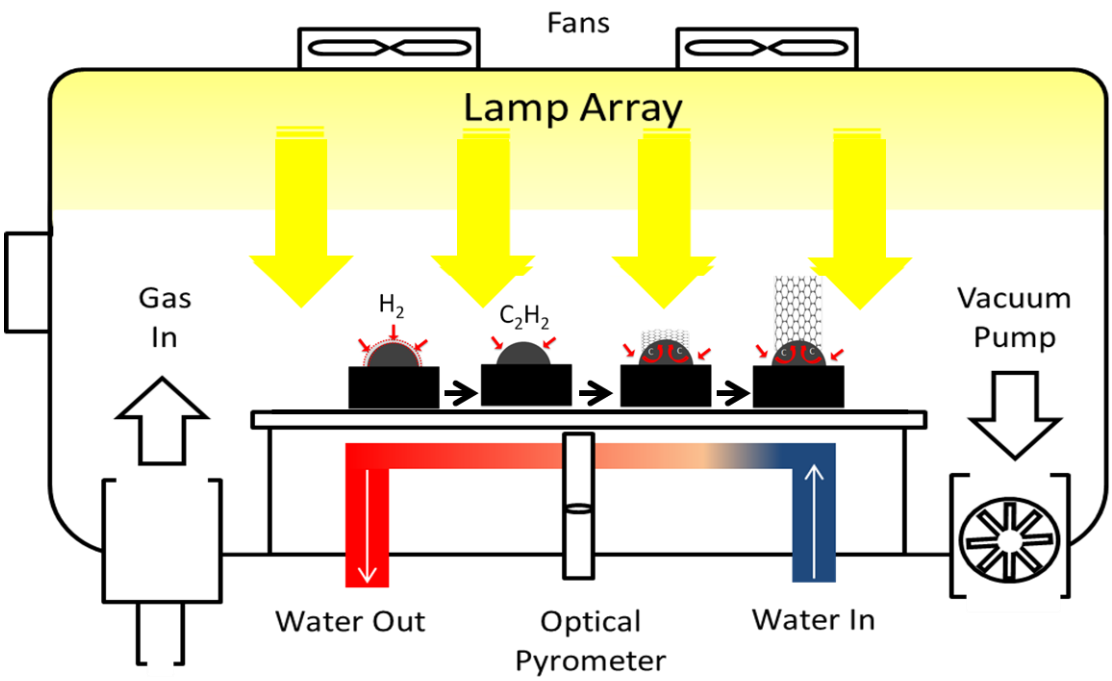

Fig. S1. Schematic diagram of the photothermal chemical vapour deposition system (PT-CVD). The water-cooled chamber reduces the temperature of substrate, and reduces the time for cooling and subsequent loading of another sample. In addition, fans are used to reduce the temperature of the tungsten halogen lamps.

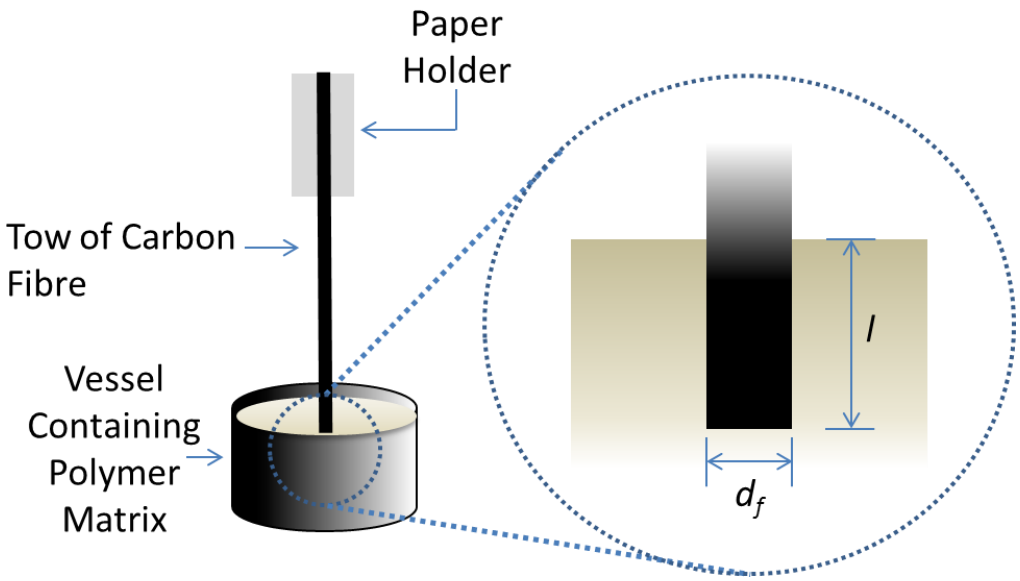

Fig. S2. Diagram of the tow pull-out test for interfacial adhesion.

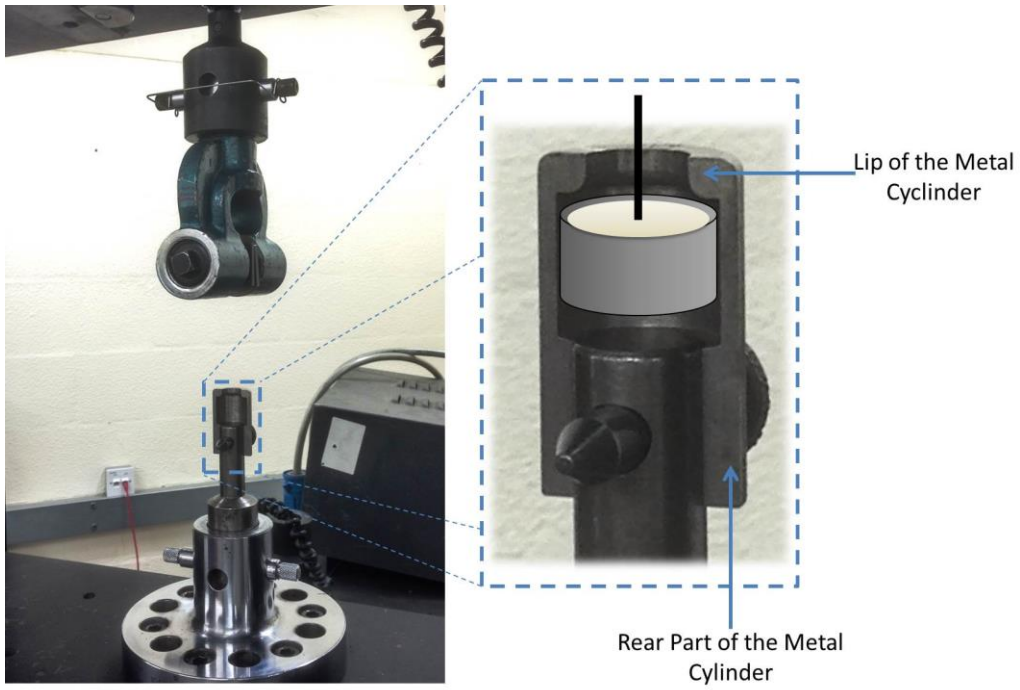

Fig. S3. Photograph of the single tow pull-out test. Inset displays where the epoxy resin – filled vessel resided during testing. The lip of the metal cylinder prevented the vessel from moving whilst the upper clamp (left image) displaces the carbon fibre tow from it.

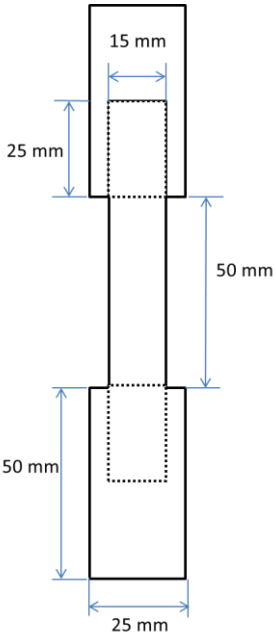

Fig. S4. Schematic diagram of the tensile test specimens complete with dimensions. The dotted area corresponds to the part of the test specimen that was attached to the metal tabs.

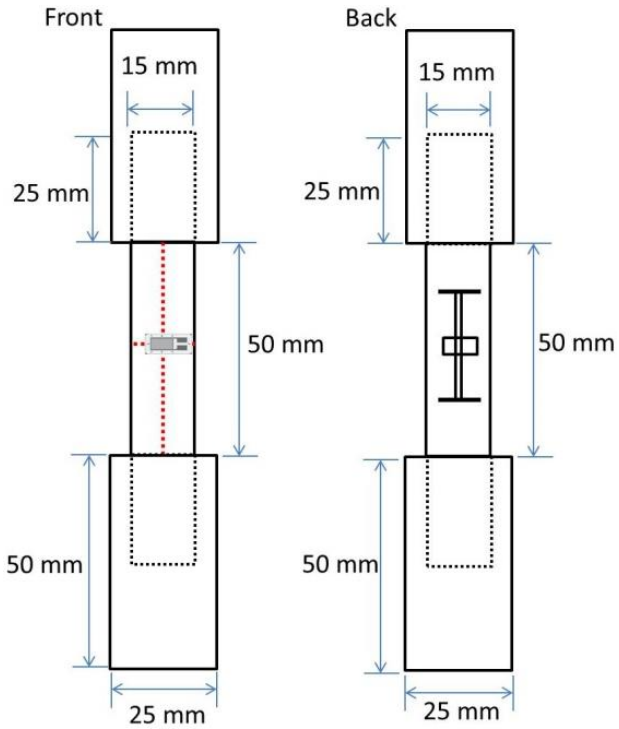

Fig. S5. Schematic diagram of the in-plane shear test sample and the location of the strain gauge (front) and the extensometer (back), where front and rear are arbitrary chosen.

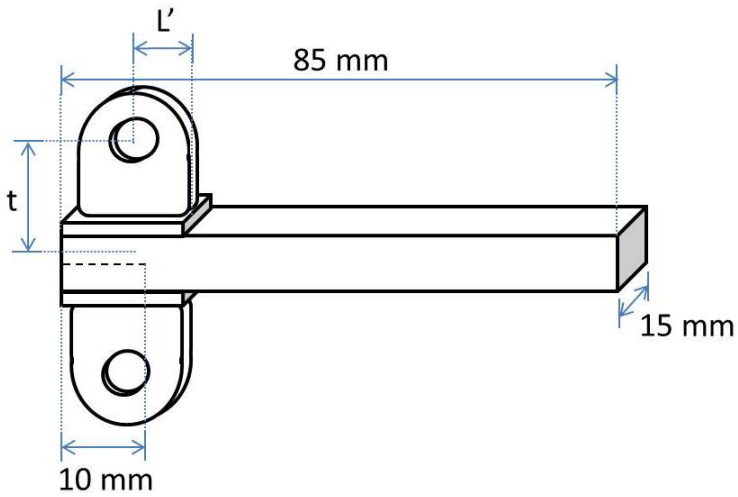

Fig. S6. Schematic diagram of the double beam cantilever sample used for the interlaminar toughness testing.

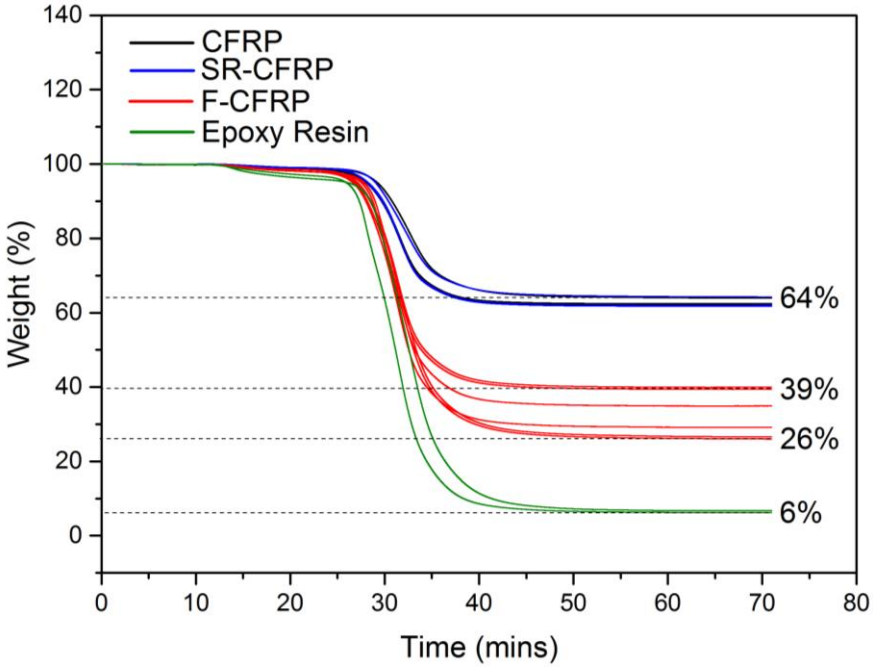

Fig. S7. TGA data of weight % *versus* time and the respective temperature profile (inset) to determine the fibre volume of each composite. Percentages shown include residue weight.